

PATENT

Atty. Dkt. No.: APPM/008241/PPG/ECP/CKIM

AMENDMENTS TO THE CLAIMS

Please cancel claims 1-7, 11, 13-15, 17-19, 23-28, 30 and 34-36 and amend the claims as follows:

1-7. (Cancelled)

8. (Currently Amended) ~~The method of claim 7, further comprising~~ A method for depositing a copper seed layer onto a substrate surface containing a barrier layer, comprising:

exposing the substrate surface to a copper solution containing complexed copper ions and having a pH value of less than 7, wherein the complexed copper ions are derived from a copper source selected from the group consisting of copper citrate, copper borate, copper tartrate, copper oxalate, derivatives thereof and combinations thereof;

applying an electrical bias across the substrate surface;

reducing the complexed copper ions with the electrical bias to deposit the copper seed layer onto the barrier layer; and

depositing a copper gap-fill layer by:

exposing the substrate surface to a second copper solution containing free-copper ions; and

applying a second electrical bias across the substrate surface to deposit the copper gap-fill layer onto the copper seed layer.

9. (Currently Amended) The method of claim 8, further comprising depositing a copper bulk-fill layer by:

exposing the substrate surface to a third copper solution containing free-copper ions; and

applying a third electrical bias across the substrate surface to deposit the copper bulk-fill layer onto the copper gap-fill layer.

PATENT

Atty. Dkt. No.: APPM/008241/PPC/ECP/CKIM

10. (Original) The method of claim 9, wherein at least one leveling agent is added to the second copper solution to form the third copper solution.

11-19. (Cancelled)

20. (Currently Amended) ~~The method of claim 19, further comprising~~ A method for depositing a copper seed layer onto a substrate surface containing a barrier layer, comprising:

exposing the substrate surface to a complexed copper solution containing complexed copper ions derived from a copper source selected from the group consisting of copper citrate, copper borate, copper tartrate, copper oxalate, derivatives thereof and combinations thereof;

reducing the complexed copper ions with an electroplating technique to form the copper seed layer on the barrier layer; and

depositing a copper gap-fill layer by:

exposing the substrate surface to a first copper solution containing free-copper ions; and

applying a second electrical bias across the substrate surface to deposit the copper gap-fill layer onto the copper seed layer.

21. (Currently Amended) The method of claim 20, further comprising depositing a copper bulk-fill layer by:

exposing the substrate surface to a second copper solution containing free-copper ions; and

applying a third electrical bias across the substrate surface to deposit the copper bulk-fill layer onto the copper gap-fill layer.

22. (Previously Presented) The method of claim 21, wherein at least one leveling agent is added to the first copper solution to form the second copper solution.

23-30. (Cancelled)

PATENT

Atty. Dkt. No.: APPM/008241/PPC/ECP/CKIM

31. (Currently Amended) ~~The method of claim 23, further comprising~~ A method for depositing a copper seed layer onto a substrate surface containing a barrier layer, comprising:

exposing a substrate surface to a complexed copper solution containing complexed copper ions derived from a copper source selected from the group consisting of copper citrate, copper borate, copper tartrate, copper oxalate, derivatives thereof and combinations thereof;

reducing the complexed copper ions with an electrical bias to form the copper seed layer on the barrier layer, wherein the electrical bias has a current density of less than about 10 mA/cm² across the substrate surface; and

depositing a copper gap-fill layer by:

exposing the substrate surface to a second copper solution containing free-copper ions; and

applying a second bias across a the substrate surface to deposit the copper gap-fill layer onto the copper seed layer.

32. (Previously Presented) The method of claim 31, further comprising depositing a copper bulk-fill layer by:

exposing the substrate surface to a third copper solution containing free-copper ions; and

applying a third bias across the substrate surface to deposit the copper bulk-fill layer onto the copper gap-fill layer.

33. (Original) The method of claim 32, wherein at least one leveling agent is added to the second copper solution to form the third copper solution.

34-36. (Cancelled)